2011
Canine serosurvey

Lyme disease and anaplasmosis prevalence

VERMONT
DEPARTMENT OF HEALTH

Lyme disease and anaplasmosis prevalence
Results of 2011 canine serosurvey

In the northeastern United States, Lyme disease is caused by the spirochete *Borrelia burgdorferi* and is transmissible through the bite of an infected deer tick, *Ixodes scapularis*. More than 22,500 confirmed cases and 7,500 probable cases of human Lyme disease were documented in 2010, making it the most common vector-borne disease nationwide (Centers for Disease Control [CDC], 2011). States that reported the highest incidence of Lyme disease in 2010 were Delaware, New Hampshire, Connecticut, Wisconsin and Vermont (CDC, 2011).

The number of confirmed and probable human cases of Lyme disease reported to the Vermont Department of Health (VDH) climbed from 40 cases in 2000 to over 350 cases in 2010. Lyme disease is most prevalent in southern Vermont with 2010 incidence rates of >100 cases per 100,000 people in Rutland and Windsor counties and >200 cases per 100,000 people in Bennington county.

Increasing trends in Lyme disease diagnoses have encouraged the development of new surveillance methods; approaches are being explored to monitor the risk of human infection and to predict areas of disease emergence. Recent findings suggest that human Lyme disease surveillance can be enhanced by monitoring canine seroprevalence in endemic areas (Mead, et al 2011). Dogs are especially susceptible to *B. burgdorferi* infection due to their frequent exposure to tick habitats, and a quantifiable immune response is elicited as a result of infection.

In 2004, VDH conducted a study to assess the prevalence of Lyme disease in dogs that undergo routine veterinary screenings. This study was repeated in 2011 in order to identify trends in disease prevalence by re-examining the number of dogs with serological evidence of infection. Since some screening tests can detect anaplasmosis infection, the prevalence of this disease was also examined. Data collected from the 2011 study are presented in this report.

Methods:

Questionnaire

A cross-sectional study of Vermont veterinary practices was carried out using a 6 item questionnaire. Veterinarians were asked to provide information regarding the type of test they used to screen dogs, the number of dogs screened per year, and the number of dogs that tested positive for Lyme disease and anaplasmosis between 2008 and 2010. Veterinarians had the option of filling out the questionnaire and returning it to VDH by mail in the envelope provided, or completing the questionnaire online through surveymonkey.com.

Sample

The mailing addresses of all licensed Vermont veterinarians were attained using publicly available information on Vermont Department of State website. On June 30th, 2011, a total of 487 questionnaires were mailed to individual veterinarians, although only one response per veterinary practice was requested. On July 28th, 2011, a reminder was sent by email to veterinarians on the State Public Health Veterinarian's email list. By September 15th, 2011, 74 veterinarians from Vermont had completed questionnaires on behalf of their practices and submitted their results to the VDH.

Canine Screening
IDEXX Snap tests are point-of-care diagnostic tools used to screen animals for commonly acquired vectorborne diseases. Tests are highly specific and use enzyme linked immunosorbent assay (ELISA) technology to detect evidence of current or past infection. The IDEXX 4Dx and IDEXX 3Dx are both capable of detecting heartworm, Lyme disease, and ehrlichiosis in dogs with clinical and subclinical infections. The IDEXX 4Dx test can additionally detect evidence of anaplasmosis infection. The 3Dx and 4Dx Snap tests are sensitive and specific assays that do not cross-react with antibodies elicited by Lyme disease vaccines.

Analysis
Data from responding veterinary practices were organized and analyzed using Excel 2003 (Microsoft). OpenEpi Version 2.3.1 (Emory) was used to determine the statistical significance of trends in Lyme disease prevalence.

Veterinary Screening Methods for Dogs (2008-2010)

A total of 74 practices responded to the survey. Fifty-five respondents stated that they routinely tested asymptomatic dogs for Lyme disease. Of these, 43 replied that they used the IDEXX 4Dx screening system alone, 8 responded that they used only the IDEXX 3Dx screening system and 4 replied that they have used IDEXX 4Dx and another screening system between 2008 and 2010. Of the 19 practices that did not test dogs, 13 replied that they did not test animals without further comment and 6 stated that they were large animal practices, therefore did not use IDEXX systems **[Figure 1].** Thirty- five practices provided adequate data to be used in this study.

Figure 1. Lyme disease testing methods (2008-2010) of responding veterinary practices

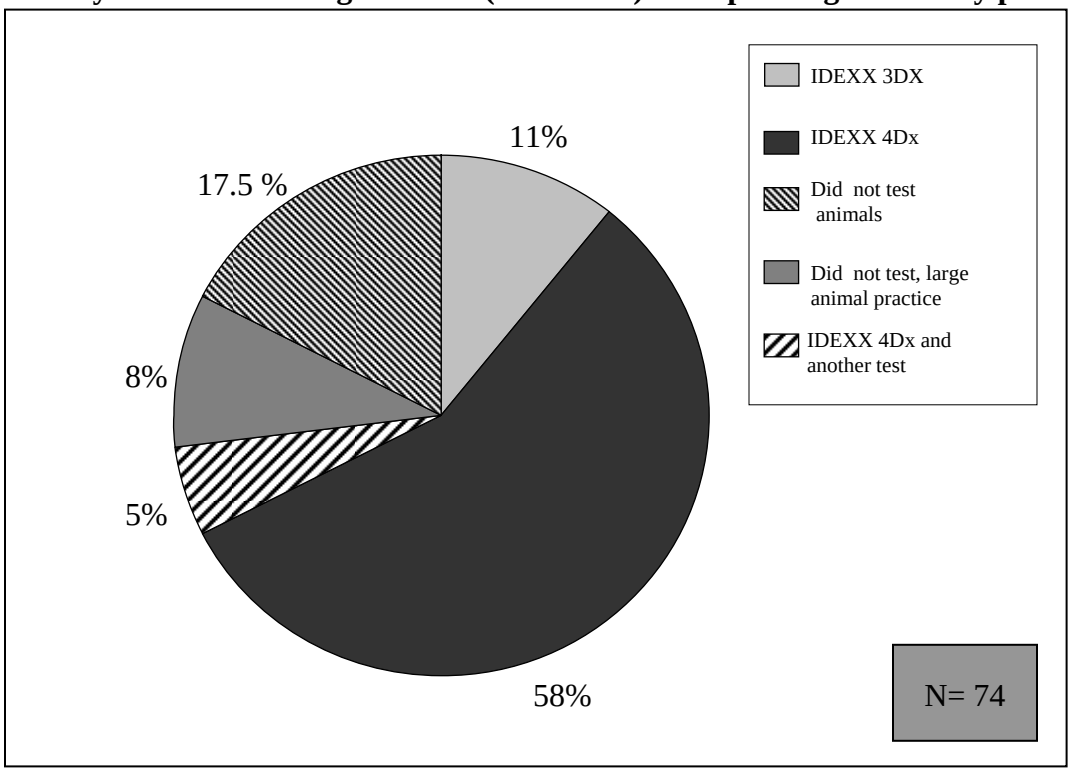
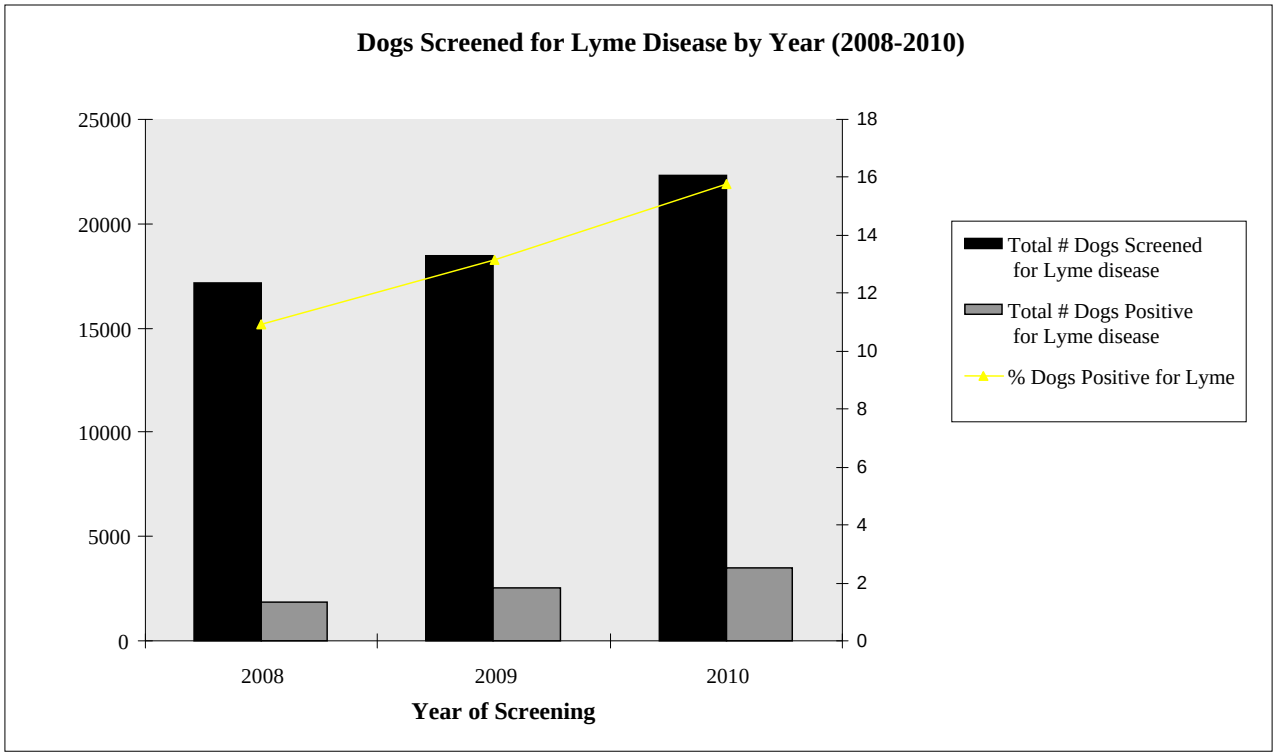


Figure 2. Dogs Screened for Lyme disease by year (2008-2010)



The number of tests animals routinely screening for Lyme disease increased between 2008 and 2010 from 17,174 tests to 22,325 tests **[Figure 2, Table 1]**. A notable increase in anaplasmosis screening was observed; 16,581 dogs were screened in 2010 compared to 13,736 dogs in 2008 **[Table 1]**. As a result of increased surveillance, the number of Lyme disease and anaplasmosis-positive animals consequently increased. However, the increase in the percent of positive animals is statistically significant, which suggests an increasing trend in disease prevalence.

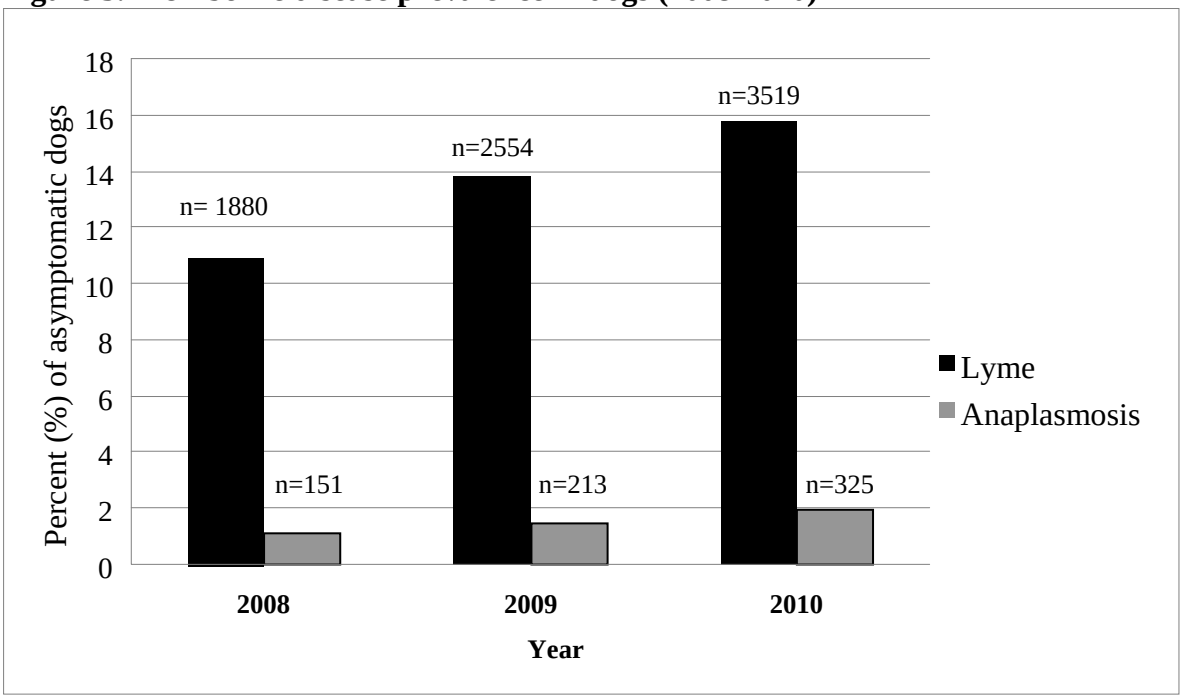
Table 1. Dogs Screened for vector-borne disease by year (2008-2010)

	2008	2009	2010
# Dogs Screened for Lyme Disease (35 practices)	17,174	18,446	22,325
# Dogs Screened for Anaplasmosis (29 practices)	13,736	14,564	16,581

2011 Serosurvey Results

The percentage of dogs presenting serological evidence of Lyme disease increased from 10.95% in 2008 to 15.76% in 2010 **[Figure 3]**. Although anaplasmosis is less commonly observed than Lyme disease, it is becoming increasingly prevalent in Vermont. The number of dogs that tested positive for anaplasmosis increased from 1.099% to 1.960% **[Figure 3]** between 2008 and 2010.

Figure 3. Tick-borne disease prevalence in dogs (2008-2010)



The estimated prevalence of tick-borne diseases varies by county and may be influenced by factors such as population density, surveillance measures and utilization of the IDEXX 4Dx screening system. Counties consistently reporting the greatest prevalence of *B. burgdorferi* and *A. phagocytophilum* infection in dogs are those located in southwestern Vermont **[Table 2, Table 3]**.

Table 2. Lyme disease prevalence by county* (Total, 2008-2010)

	Total # dogs screened	Total # dogs positive	% dogs positive
Addison	218	52	24.0
Bennington	8279	1948	23.5
Caledonia	2183	150	6.9
Chittenden	19308	1864	9.7
Franklin	1470	265	18.0
Grand Isle	678	53	7.8
Lamoille	1292	87	6.7
Orange	4566	688	15.1
Orleans	483	28	5.8
Rutland	5495	1250	22.8
Washington	1637	120	7.3
Windham	5724	707	12.4
Windsor	6612	741	11.2

*No data available from Essex County

Table 3. Anaplasmosis prevalence by county* (Total, 2008-2010)

	Total # dogs screened	Total # dogs positive	% dogs positive
Addison	218	2	0.9
Bennington	8279	272	3.29
Caledonia	2183	4	0.2
Chittenden	9753	96	0.98
Franklin	1470	2	0.1
Grand Isle	678	10	1.5
Lamoille	1292	22	1.7
Orange	1758	31	1.80
Orleans	483	9	2.0
Rutland	5495	56	1.0
Washington	1637	24	1.5
Windham	5443	64	1.2
Windsor	6192	97	1.6

*No data available from Essex County

Comparison of 2011 and 2004 Data

When compared with results from the 2004 study, recent data suggest a increasing trend in the percentage of Lyme-positive dogs **[Figure 4]**, with an overall increase in positive screenings from 9.51% in 2003 to 15.76% in 2010. Counties that experienced the most significant changes in Lyme disease prevalence were Rutland County and Franklin County. Considerable increases were also been observed in Addison, Chittenden, and Windsor counties **[Table 4]**.

Figure 4. Lyme disease in dogs (2001-2003, 2008-2010)

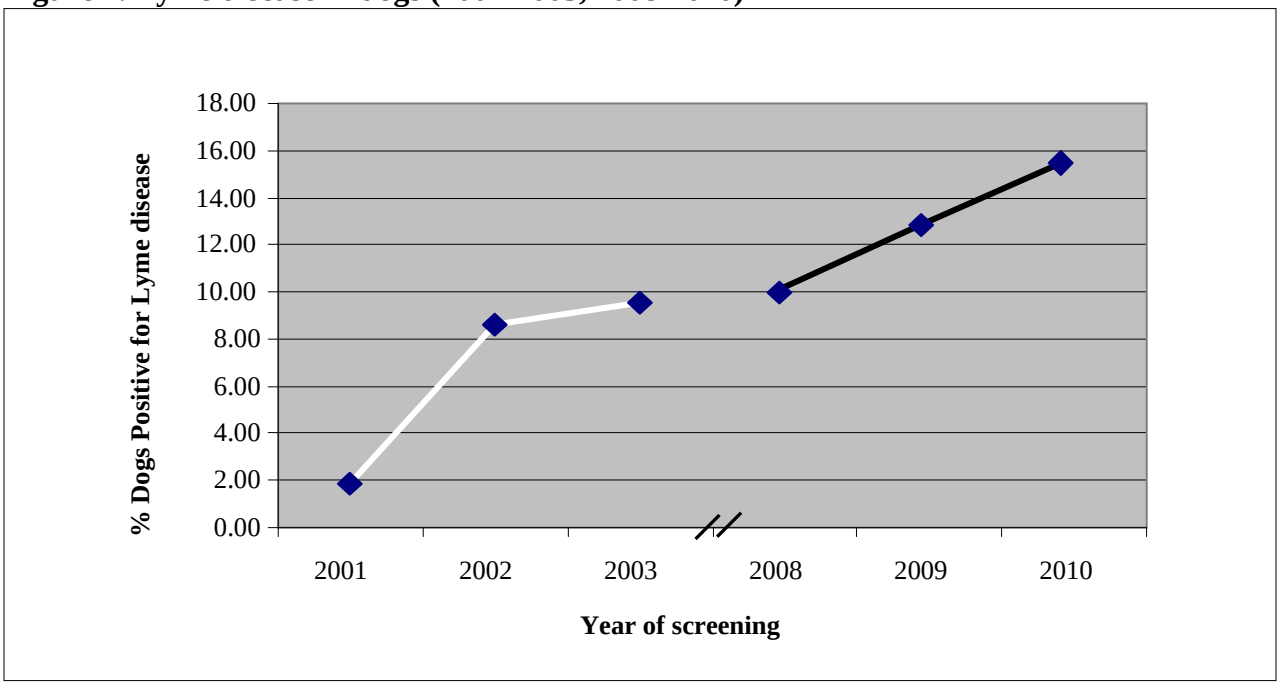
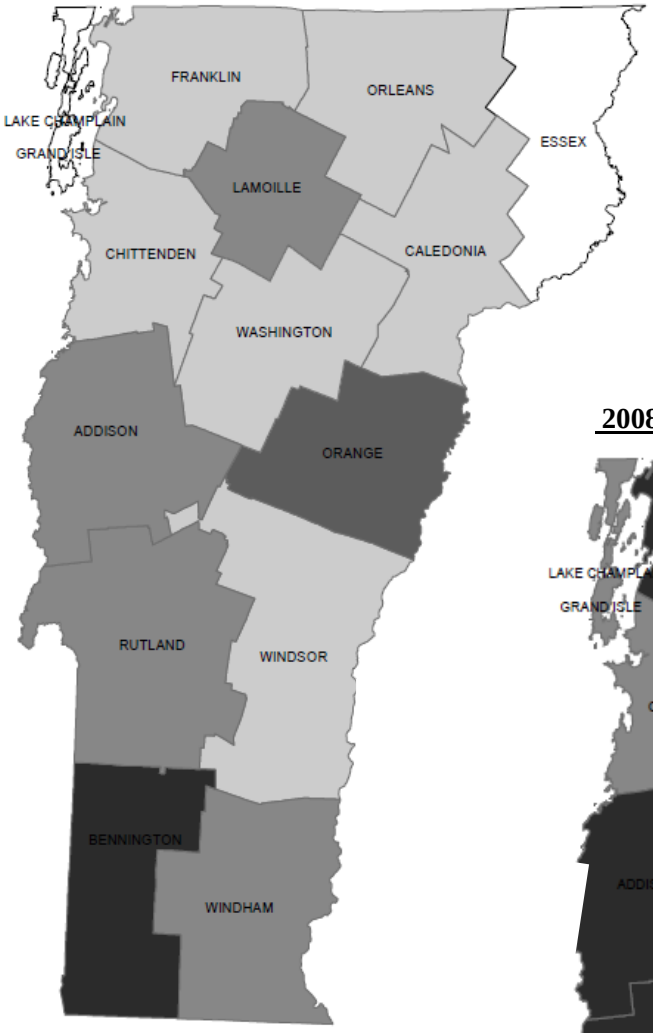


Figure 5. Canine Lyme Disease Seroprevalence: 2001-2003, 2008-2010

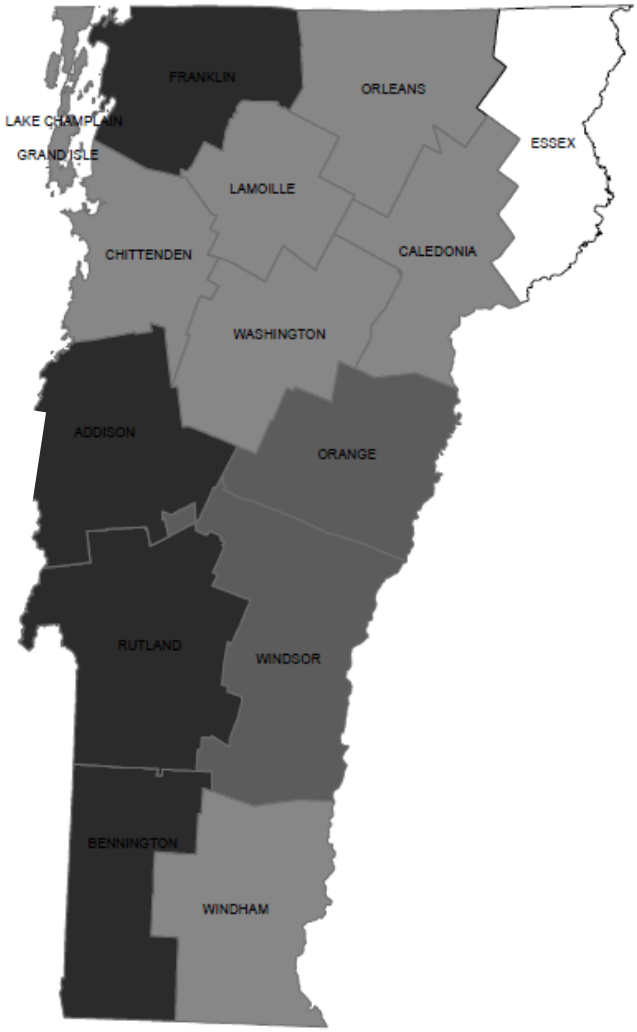
2001-2003



Percent of dogs testing positive for Lyme disease

- No/Limited Data
- < 5.00%
- 5.01% - 10.00%
- 10.01% - 15.00%
- >15%

2008-2010



Comparison Maps:
Lyme disease prevalence by county. Data based on IDEXX Snap 3Dx and 4Dx tests, reported by location of practice.

Notes:
Dogs' travel history not known. Dogs may be counted more than once. Results based on a sample and may not be representative of all dogs.

Table 4. Change in percent positive for Lyme disease per county* (2003, 2010)

	2003 % positive	2010 % positive	2003-2010 Change in % positive	(95% CI)
Addison	9.08	23.85	14.77	(8.80, 20.75)
Bennington	19.46	23.17	3.72	(1.55, 5.88)
Caledonia	5.33	6.48	1.15	(-1.20, 3.51)
Chittenden	4.30	14.0	9.73	(8.26, 11.20)
Franklin	4.58	21.5	16.93	(13.97, 19.89)
Grand Isle	N/A	7.48	-	-
Lamoille	4.41	8.51	4.10	(1.38, 6.82)
Orange	12.15	15.83	3.68	(-1.42, 8.77)
Orleans	5.98	6.46	0.48	(-3.86, 4.83)
Rutland	6.96	26.0	19.03	(16.8, 21.27)
Washington	27.27**	8.0	-19.27	(-45.68, 7.13)
Windham	10.66	12.42	1.76	(-0.12, 3.65)
Windsor	6.44	12.77	6.33	(4.68, 7.98)
Total	**9.51**	**15.76**	**6.25%**	**(5.58, 6.93)**

*No data available from Essex County
** Based on small sample size

Box: Limitations of the 2011 Lyme disease serosurvey

The objective of this study was to gain a general awareness of tick-borne disease prevalence and distribution throughout Vermont. It is important to consider the limitations in conducting this analysis, including limited practice response, dogs' travel history, small sample sizes, and widespread vaccine use in high-prevalence areas. A single dog may undergo testing once a year for multiple years. As a result of these factors, the estimated number of positive animals per county conjectured in this survey may vary from the number of positive animals encountered in individual practices.

Conclusion:

Lyme disease is present in nearly every county of Vermont. Over the last decade, prevalence has increased in most areas of the state. The majority of the human Lyme disease cases occur in the southern half of the Vermont, in regions where the prevalence of canine disease is highest. This study also indicates that anaplasmosis is present in most counties, although at much lower levels. Canine anaplasmosis is most prevalent in the southwest corner of the state, and while only a handful of human anaplasmosis cases have been reported in Vermont, most were residents of Bennington County. Low levels of anaplasmosis in dogs could indicate that the risk for human illness is also low. Future studies will be beneficial in determining whether the prevalence of vector borne disease in dogs can be an accurate indicator of the risk for human infection.

Works Cited

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